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OATS IN THE NORTH-CENTRAL STATES

OATS rank third among the important cereal crops of the United States. In the Corn Belt this crop is exceeded in importance only by corn. The 12 North-Central States—Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, Kansas, Nebraska, and the Dakotas—include about three-fourths of the total oat acreage and produce about four-fifths of the total crop of the United States. Regardless of these facts, less attention has been given to the production of oats than to any other important grain crop. As a result, yields frequently have been low and the crop sometimes unprofitable.

The essentials for growing oats most successfully in the spring-oat belt are as follows:

A well-prepared seed bed on land that is retentive of moisture and fairly fertile.

Good seed of adapted, high-yielding varieties, cleaned and graded, and treated with formaldehyde for smut.

Early seeding, preferably with a grain drill.

Harvesting the crop at the proper time for yield and quality.

Preserving the crop from weathering by shocking and stacking properly.

Efficient threshing.

Directions for growing oats more successfully in the North-Central States are given in the following pages.

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OATS IN THE NORTH-CENTRAL STATES

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IMPORTANCE OF OATS IN THE NORTH-CENTRAL STATES

Oats constitute the third most important grain crop of the United States. Like corn, oats are grown in every State, but the crop is of most importance in the region extending westward from New York to North Dakota and south almost to the latitude of the Ohio River. The center of greatest production, however, is in the central portion of this area, the Corn Belt, in which oats are exceeded in importance only by corn. This great spring-oat area, embracing the Corn Belt with its surrounding territory as here roughly outlined, includes about three-fourths of the total acreage of oats and produces about four-fifths of the total oat crop of the United States. Statistics on acreage and production for the 12 States included wholly or partially in this area are shown in Table 1.

TABLE 1.—*Oat acreage and production in each of the 12 States comprising the spring-oat belt, with totals for that area and for the United States in 1919*

[Data compiled from the Thirteenth Census]

State	Acres	Bushels	State	Acres	Bushels
Iowa	5,484,113	187,045,705	Missouri	1,707,055	40,493,700
Illinois	4,291,066	129,104,668	Michigan	1,514,808	36,956,425
Minnesota	3,429,079	89,108,151	Ohio	1,452,052	46,818,330
Wisconsin	2,251,919	68,296,223	Kansas	1,415,928	36,257,356
North Dakota	2,073,162	30,294,074			
Nebraska	2,029,740	59,819,545	North Central States[1]	29,206,759	827,815,804
South Dakota	1,839,089	51,091,904	United States	37,991,002	1,055,182,798
Indiana	1,718,748	52,529,723			

[1] Acres, 76.9 per cent of total; bushels, 78.5 per cent of total.

The distribution of the oat acreage in the United States in 1919 is shown in Figure 1.

Oats as a money crop in much of this area are not so important as corn and wheat. They have maintained a place in the Corn-Belt agriculture because of their value as an intermediate or transitional crop between corn and grass and as a feed grain for farm animals. They are grown more generally in this section than is any other crop as a nurse crop for grass, clover, and alfalfa. Oats fit into the rotation better and make a more satisfactory nurse crop than some of the other small grains. As a feed for horses, dairy cows, young animals, and breeding stock, they are unsurpassed. The balanced nutritive value of oats for the building of bone and muscle is not equaled by that of any other cereal.

The use of the automobile and the tractor has greatly decreased the demand for oats as horse feed. However, that portion of the crop

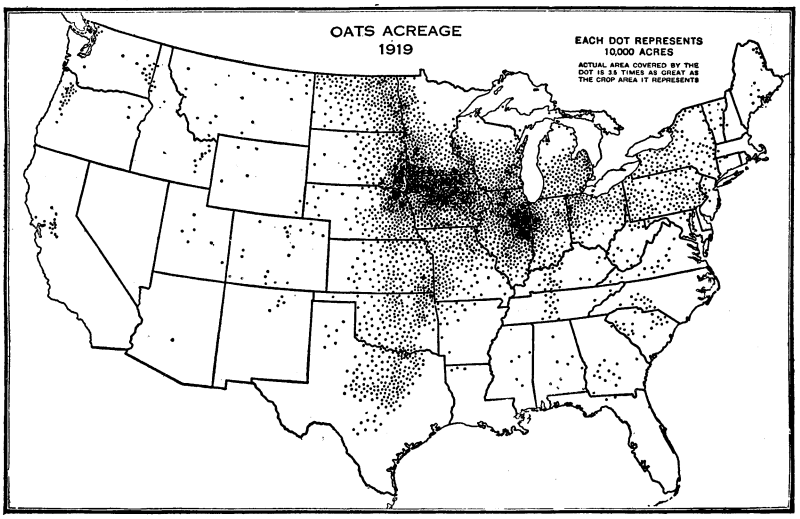

FIGURE 1.—Outline map of the United States, showing the distribution of oat acreage according to the census of 1919

formerly consumed by horses now is being fed, at least in part, to young stock and dairy cattle.

CLIMATE OF THE NORTH-CENTRAL STATES

The climate of the section immediately north of the Corn Belt, embracing for the most part the States of Michigan, Wisconsin, Minnesota, and the eastern half of the Dakotas, is well adapted to the growing of oats. On the other hand, the warmer summer climate of the Corn Belt proper is not so favorable to the best growth of the oat plant. That the center of greatest oat production of the United States lies in an area that fails decidedly to meet the ideal climatic requirements of the crop is one of the paradoxes of American agriculture. The reason for this lies in the fact that other considerations make oats one of the best crops available for developing a satisfactory cropping system where corn is the leading crop.

The oat crop as it is often grown is unprofitable, its value coming from indirect benefits incident to management and rotation. To increase the direct profits from oats, it is desirable to use the best cultural methods and practices in growing the crop. The importance of choosing varieties and strains of oats peculiarly adapted to prevailing soil and climatic conditions also can not be overemphasized.

Throughout this area rainfall usually is sufficient for the best growth of the crop. Late spring freezes very rarely produce injury. Droughts occurring in May and June, however, may reduce yield and lower the quality of the grain. Losses from these factors can be offset to some extent by thorough tillage in seed-bed preparation and by growing early drought-escaping varieties, especially in the Corn-Belt section.

SOILS

The soils of this area generally are well adapted to oats. The rich prairie loams as a group constitute the best soils of the world for the production of oats and other cereals.

Because of the greater water-holding capacity of loam soils, they usually produce better crops of oats than the more sandy soils. Nevertheless, oats may be grown satisfactorily on sandy soils provided they are well supplied with plant food and have a subsoil that is fairly retentive of moisture. Heavy, poorly drained clays in most seasons are too wet and cold for the best growth of the crop. Oats require more water to produce a pound of dry matter than does any other cereal. Soils that are capable of retaining and supplying to the crop sufficient moisture, therefore, should be used. Soils in poor tilth and deficient in organic matter are not the best for oats. One of the essential requirements for oats is that the soil be well drained. Oats grown on very rich, undrained soils usually lodge badly and suffer injury from plant diseases such as rust and mildew.

FERTILIZERS AND MANURES

Fertilizers are not generally used for oats in this area except in the eastern portion. Until comparatively recent years the native fertility of the black prairie soils was more than sufficient for the best growth of the oat plant. In the virgin state the high nitrogen content of these soils was detrimental rather than beneficial to the crop. This condition produced an exceedingly rank, soft growth of straw, which often lodged badly. Abnormal vegetative growth favors rust infection and the development of other diseases. The direct application of barnyard manure to oats may produce similar results and is rarely advisable. Barnyard manure usually should be applied to the preceding tilled or row crop, such as corn, potatoes, or beans. The residual effect of the manure will greatly benefit the oats, with little likelihood of developing too much straw growth at the expense of grain production. Only on rather thin soils is it at all safe to apply manure directly to oats, and then best results are obtained when it is applied in combination with some form of phosphate fertilizer. Fertilizers usually give the greatest profits when applied to other crops than oats and in general practice are less used on the latter.

Of the three major plant-nutrient elements found in soils—nitrogen, phosphorus, and potash—a deficiency of nitrogen and phosphorus is most common. On soils that have been continuously cultivated, a nitrogenous fertilizer in connection with phosphorus often can be used on oats with good results. If commercial nitrogen is used, a readily available form, such as nitrate of soda, ammonium sulphate, or dried blood, is preferable. This is owing to the fact that most of the growth of the oat plant is made in the early part of the season when the weather is cool and before the soil nitrogen is converted into a form available for plant use. In soils where potash is deficient it usually can be supplied to some other crop in the rotation to better advantage. Potash, as a rule, is present in sufficient quan tities for oats in most of the soils of the area herein considered. Where some manure is used in connection with occasional green-manure crops and phosphorus is supplied in fairly liberal quantities, there is little danger of a deficiency of potash.

A satisfactory fertilizer for oats on soils of only fair fertility is one containing about 50 pounds of nitrate of soda, 150 pounds of superphosphate, and 25 pounds of muriate of potash to the acre.

For most soils of this area, especially in the eastern portion, where fairly liberal quantities of barnyard manure and some crop residues are available and are generally used, the application of 200 to 250 pounds of superphosphate at the time of sowing is one of the best fertilizer treatments for oats. In any section the kind and quantity of fertilizing material to apply depends largely upon the condition and fertility of the soil and the price of the fertilizers. On soils naturally rich in nitrogen, oat straw sometimes may be strengthened by the use of light applications of phosphorus and potash.

The application of lime (calcium) alone is not likely to increase the yield of oats. However, where soils are very acid, liming may prove beneficial to the crop. The function of lime primarily is to improve the physical and chemical condition of the soil and thus make it more favorable to plant growth.

ROTATIONS

A good rotation for oats, as well as for almost any other farm crop, is one that includes both cultivated and legume crops. Ordinarily oats are not sown on sod land, as corn or other row crops occupy this position more advantageously. As previously mentioned, oats are grown in much of this area, particularly in the Corn Belt, largely because of their value in rotations. Where corn remains standing in the field until freezing weather before being harvested, spring-sown oats follow the corn crop with less derangement of labor and other requirements than would winter wheat, for example. Oats also meet the need for a nurse crop in seeding grass, clover, and alfalfa. The yield of oats also is less influenced by the preceding crop than is that of such crops as corn, wheat, and barley. Because of the adaptability of oats, rotations generally are arranged to meet the needs of the other major crops rather than those of oats.

ROTATIONS INCLUDING OATS

The most common rotation in the Corn Belt consists of oats preceded by corn and followed by grass or clover. Sometimes this

is extended to a 5-year rotation, including corn 2 years in succession, oats 1 year, and clover or grass 2 years. The grass and clover are sown with the oats, which serve as a nurse crop. The grass is allowed to remain for two years as either meadow or pasture; the ground is then plowed for corn. Most often, however, this rotation is reduced to a 4-year sequence, including 2 crops of corn and 1 each of oats and clover, or 1 crop each of corn and oats and 2 of clover and grass. Where clover is sown only as a hay crop the first of these rotations is most commonly followed. Where winter wheat is grown on a considerable acreage it usually supplants oats as a nurse crop for clover and grass. A common rotation for this system is corn, oats, and winter wheat, one year each, followed by clover and grass for one or more years. Another sequence is winter wheat, corn, oats, and clover one year each. In this rotation manure usually is applied on the winter-wheat stubble.

In recent years soy beans have been increasingly grown in the Corn Belt. The soy bean, being commonly grown as a tilled crop, tends to supplant corn rather than oats in the rotation. As a result, the acreage of oats has not been materially affected, especially in those districts where a relatively small acreage of winter wheat is grown and oats are used as the nurse crop for clover and grass. For further information on the value of crop rotation in farming economy and on the principles of rotation in their relation to the maintenance of soil productivity and to soil improvement, see Farmers' Bulletin 1475.[1]

GROWING IN MIXTURE WITH OTHER GRAINS

In the spring-oat belt about the only grain mixture grown to any considerable extent is oats and barley. This practice is confined to the dairy districts of the more northern States. These crops in combination sometimes yield more than either when sown alone. It is necessary to use an early variety of oats, so that the two crops will ripen at about the same time. These mixed crops are grown primarily for feeding on the farms where they are produced, as they are not readily marketable as mixed-feed grains. Best results usually are obtained from sowing about 1 bushel each of oats and barley per acre. Spring wheat and other spring-sown grains may be grown in combination with oats, but as a rule they are not so satisfactory as the oat-barley mixture.

OATS AS A NURSE CROP

Oats are the most common nurse crop for clover and grass in the North-Central States. They are not ideal for this purpose, because the foliage is too dense and the crop draws too heavily on soil moisture. These objections are largely overcome by using early, short-strawed varieties. Such varieties require less water and produce less shade than the later maturing, taller growing ones. To obtain the best stands of clover or grass, it sometimes is advisable to seed the oats at less than the normal rate if grown only for grain. This allows more space, moisture, and plant food for the young grass or clover plants. When used as a nurse crop, oats should be drilled. The space between the rows permits more light and air

[1] WEIR, W. W. SOIL PRODUCTIVITY AS AFFECTED BY CROP ROTATION. U. S. Dept. Agr., Farmers' Bul. 1475, 22 p., illus. 1926. (Out of print; may be consulted in libraries.)

to reach the grass or clover plants than is possible if the oats are sown broadcast.

VARIETIES TO GROW

There are many so-called commercial varieties of oats. These for the most part represent strains of a relatively small number of distinct botanical varieties. Two strains of oats may be identical in plant characters and yet differ greatly in inherent yielding power. The best measure of the value of a variety or strain is its yield of grain. This depends largely upon the ability to withstand adverse soil and weather conditions and to resist rust and other plant diseases.

For convenience, varieties of oats usually are grouped first according to whether the panicle is of the spreading (equilateral) or side (unilateral or horse-mane) type. Of these two types, the varieties with spreading panicles are of much the greater importance. Within this first group the varieties usually are classed according to the time of maturity, as early, midseason, and late. Practically all the varieties with side panicles are late oats. After classifying according to time of ripening, a further grouping is made on the basis of kernel color. Most of the oats grown in the area under consideration have yellow or white kernels. Varieties with black kernels have become almost obsolete, owing to market discrimination against this color.

Both early and midseason varieties are grown in the area considered. In the Corn Belt early varieties predominate, as ordinarily they mature before the advent of hot weather, thus escaping injury from heat and drought. North of the Corn Belt midseason varieties usually are preferable, being more productive under the cooler climatic conditions.

EARLY VARIETIES

Among the early-maturing varieties formerly grown rather extensively in the Corn Belt are Early Champion and Burt (June, Early Ripe, Early May, Fourth of July, etc.). These varieties are more or less unsatisfactory. Early Champion is susceptible to the smuts of oats and is a relatively poor yielder. It also has a very weak straw. Burt usually is satisfactory in yield, especially along the southern edge of the Corn Belt, but it lacks uniformity, ripens unevenly, and produces grain of poor quality. Burt is a red oat and also is discriminated against in the markets.

The introduction of the Kherson variety from Russia in 1896 by the Nebraska Agricultural Experiment Station and the Sixty-Day variety from the same country in 1901 by the United States Department of Agriculture marked the beginning of an era in oat improvement in the United States. These early, short-strawed, high-yielding varieties soon became popular in the Corn Belt. To-day these varieties, with the various selections developed from them, constitute the most important group of oats grown in the United States. The distribution of the Kherson and Sixty-Day varieties in 1919 is shown in Figure 2.

IMPROVED EARLY VARIETIES

The original Kherson and Sixty-Day varieties lack uniformity, as they have both white and yellow kernels. Several new varieties

have been developed by selecting and increasing these variations. Some of these are of considerable economic importance, largely replacing the original Kherson and Sixty-Day varieties. Among the most outstanding of the new varieties are Albion (Iowa No. 103), Gopher, Iowar, and Richland (Iowa No. 105). Other new early varieties of this same origin are Cole, Iogold, Nebraska No. 21, State Pride, and White Cross.

Albion.—Albion (Reg. No. 46[2]) originated as an individual head selection from Kherson at Ames, Iowa, in 1906. It differs from Kherson mainly in having white kernels and usually more awns. Owing to the demand for an early oat with white kernels, Albion was distributed to farmers of Iowa in 1913. In tests on Iowa farms Albion has consistently outyielded the Kherson by about 4 bushels to the acre. At present it is one of the leading early varieties of the Corn Belt. A panicle and spikelets of Albion are shown in Figure 3.

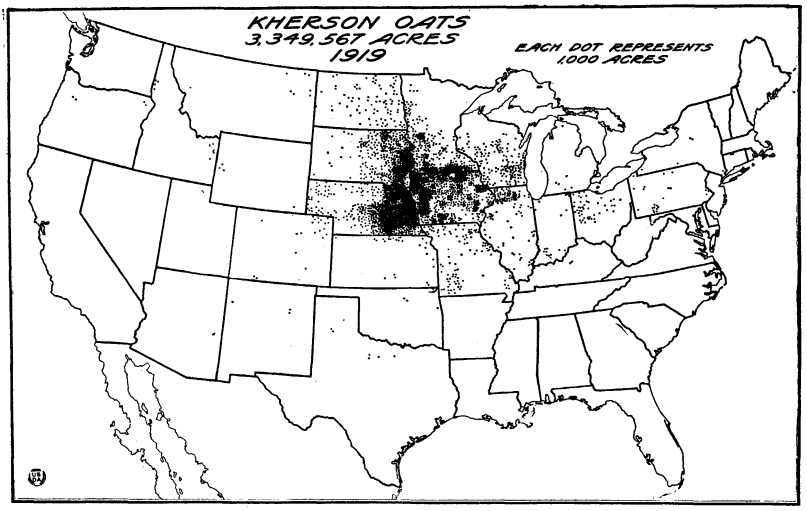

FIGURE 2.—Outline map showing the distribution of the Kherson oat in 1919. (The Sixty-Day variety is included as Kherson)

Albion generally is recommended for growing in Iowa and Illinois, where experience has shown it to be an exceedingly satisfactory variety. The distribution of Albion in 1919 is shown in Figure 4.

Gopher.—The Gopher (Reg. No. 47) oat is a selection from Sixty-Day, made and developed at University Farm, St. Paul, Minn., by the Minnesota Agricultural Experiment Station. The original head was selected in 1917. Gopher is similar to Albion, but produces slightly plumper kernels. Its superior characteristics are earliness, stiff straw, high yield, and white kernels. In experiments conducted at University Farm Gopher has been about the equal of Sixty-Day in yield.

Gopher has been developed primarily as an early variety for the northern edge of the Corn Belt, especially for southern Minnesota and southeastern North Dakota. From the standpoint of quality Gopher is one of the best strains with white kernels which has been isolated from Kherson. A panicle and spikelets of Gopher are shown in Figure 5.

Iowar.—Iowar (Reg. No. 48), like Albion, was originated as a selection from Kherson made at Ames, Iowa, in 1910 by the Iowa Agricultural Experiment Station and the United States Department of Agriculture, cooperating. Iowar is similar to Albion, but its straw is a little coarser and taller, and it ripens a

[2] Registration No. of the American Society of Agronomy and the Bureau of Plant Industry.

few days later. The desirable characters are high-yielding ability, white kernels, and straw tall enough for harvesting conveniently on thin land. A panicle and spikelets of Iowar are shown in Figure 5.

Owing to the slightly taller straw and higher yielding power of Iowar, it is replacing Albion to some extent in the Corn Belt. Like Albion this strain is recommended rather generally for the Corn Belt except in the southern part. According to a varietal survey made by the agricultural experiment station at Ames, Iowar was grown on about 800,000 acres in Iowa in 1924.

FIGURE 3.—Panicles and spikelets of the Albion (left) and Richland (right) oat varieties

Richland.—Richland (Reg. No. 44) was originated at the Iowa Agricultural Experiment Station, Ames, in 1906, as a plant selection from Kherson. It is a yellow oat. Richland differs from Kherson primarily in having a slightly shorter and finer straw and in greater uniformity. Its desirable characters are high-yielding ability, high resistance to stem rust of oats, and adaptability for growing on low, rich soils without lodging. A panicle and spikelets of Richland are shown in Figure 3.

Richland is recommended primarily for growing on bottom lands high in fertility, and where taller and later maturing varieties usually lodge. Its rust resistance also is a most valuable asset in years of severe rust epidemics. The distribution of Richland in 1919 is shown in Figure 6.

Iogold.—Iogold was originated from a plant selection from the Kherson variety in the cooperative experiments of the Iowa Agricultural Experiment Station and the United States Department of Agriculture. It is an early yellow oat, similar to Richland, but grows from 3 to 4 inches taller. It is resistant to stem rust of oats and is especially recommended for those districts in which Richland grows too short for convenient harvesting. It has been slightly superior to Iowar in yield at Ames. Iogold was first distributed to farmers in 1926, and its place in Corn-Belt agriculture remains to be determined. It is an exceptionally promising new strain, however.

Nebraska No. 21.—Nebraska No. 21 was originated as a plant selection from Kherson at the Nebraska Agricultural Experiment Station. This oat is essentially identical with Albion in plant characters and in yielding ability. Nebraska No. 21 is recommended primarily for the Corn Belt, particularly for eastern Nebraska, where it has attained a fairly wide distribution and has become a standard early variety.

Cole.—Cole is a selection from Sixty-Day made at Highmore, S. Dak., in 1907, by the South Dakota Agricultural Experiment Station. It is an early white oat similar to Albion, but is practically awnless. This strain has produced yields about equal to those of the parent variety. It has been less desirable than Albion, Iowar, and Gopher, having weaker straw and being susceptible to the

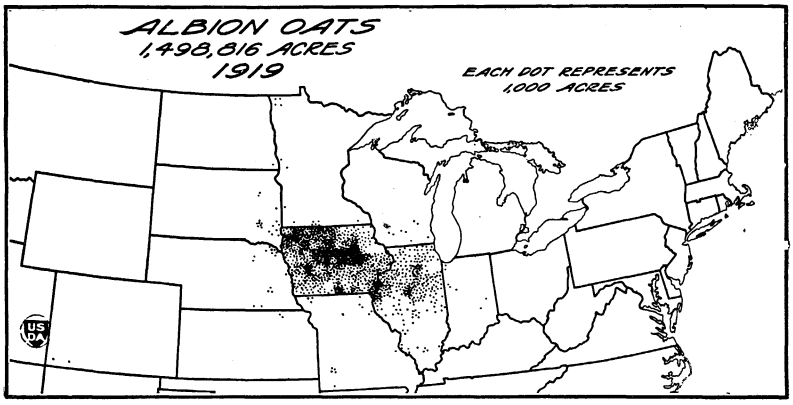

FIGURE 4.—Outline map showing the distribution of Albion (Iowa No. 103), an improved early oat, in 1919

smuts of oats. Where an early, white-kerneled, awnless oat is desired, Cole is to be recommended. Its distribution has been limited primarily to South Dakota.

State Pride.—State Pride (Reg. No. 45) is a plant selection from Kherson made at Madison, by the Wisconsin Agricultural Experiment Station in 1907. It is an early yellow oat, similar to Kherson, but grows from 6 to 8 inches taller. It is recommended as being especially adapted for growing on very fertile soil. It is said to fill well even where considerable lodging occurs. In varietal experiments at Madison it has outyielded Swedish Select, the standard midseason variety, on the average by about 12 bushels to the acre.

State Pride is recommended primarily for growing in the southern half of Wisconsin, especially on dairy farms where considerable lodging frequently occurs in oats. Its high yield and earliness have made it especially desirable where oats are grown as a nurse crop.

White Cross.—The White Cross (Reg. No. 49) variety originated as a selection from a cross between Big Four and Sixty-Day at the Wisconsin Agricultural Experiment Station, Madison. The cross was made in 1911. It is an early, white oat, similar to Albion, except that it usually produces a slightly taller straw and a little larger kernel. It has been developed especially for growing on light soils. In varietal experiments conducted at Madison the White Cross has produced an average yield 5 bushels greater than Swedish Select, the standard variety.

The White Cross variety is recommended primarily for growing on the lighter and more-sandy soils in southern Wisconsin.

Red-oat varieties.—In recent years Fulghum and a strain of Fulghum called Kanota (Reg. No. 66), both of which belong to the red-oat group, have become prominent as spring-sown varieties in the southern part of this general section and are replacing Burt. Where extreme heat is likely to occur early in the season, the red-oat varieties are superior to the common yellow and white varieties. In southern Ohio, Indiana, Illinois, Nebraska, and in Missouri and Kansas the Fulghum type of oats is coming rapidly into favor. This type, belonging to the Red Rustproof group, matures at about the same time as Burt, but is more uniform than the latter in plant characters and produces grain of better quality.

FIGURE 5.—Panicles and spikelets of the Iowar (left) and Gopher (right) oat varieties

MIDSEASON VARIETIES

Midseason or medium early-maturing varieties are preferable for much of that section lying immediately to the north of the Corn Belt. Varietal experiments conducted in Michigan, Wisconsin, Minnesota, and eastern North Dakota favor midseason rather than early varieties. Even throughout northern Ohio and Indiana, midseason oats predominate. There naturally is considerable overlapping of the ranges of varieties. For special reasons, such as unfavorable conditions at the usual planting season, early varieties sometimes are grown in districts where the larger and later sorts usually produce

higher acre yields. In other districts where little wheat is grown and straw is relatively valuable, later varieties sometimes are preferable primarily because of their greater straw yield. The choice between early and midseason varieties frequently is merely a personal one on the part of the grower, especially where both types are about equally productive.

STANDARD MIDSEASON VARIETIES

During the last 25 years such well-known midseason varietal types as Silvermine, Swedish Select, Lincoln, and Green Russian have been standard in the northern part of the spring-oat belt. The importance of these varieties is indicated by their distribution in 1919, as shown in Figures 7, 8, 9, and 10. Panicles and spikelets of Silvermine and Swedish Select are shown in Figure 11.

There are numerous other named strains of these varieties, not all of which can be mentioned in this bulletin. Some of the best known

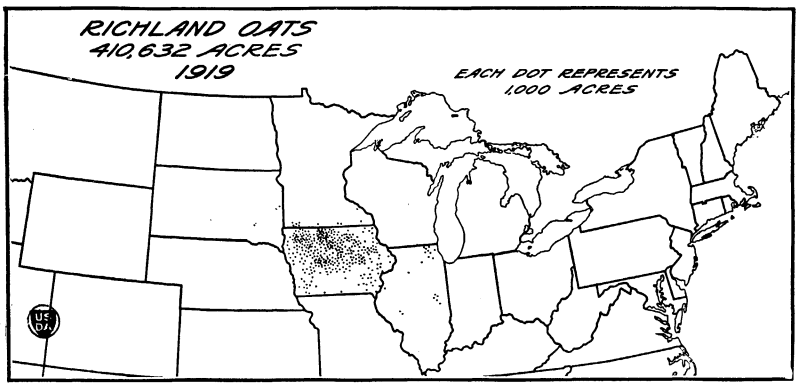

FIGURE 6.—Outline map showing the distribution of the Richland (Iowa No. 105) oat in 1919. Since 1919 this acreage undoubtedly has increased, owing to the high resistance of Richland to stem rust of oats

are Big Four, Banner, Clydesdale, Great American, Ligowa, Myrick, National, Roosevelt, Siberian, Welcome, and Wideawake. Of those which may be considered as outstanding among the newer standard varieties Golden Rain and Victory must be mentioned. These varieties were introduced from Sweden by the United States Department of Agriculture and have become standard, Victory being decidedly the more important. The yellow kernels of Golden Rain have been its most serious handicap. It is one of the most productive midseason varieties ever developed in any country.

IMPROVED MIDSEASON VARIETIES

Many improved varieties and strains of midseason oats have been developed in recent years by agricultural experiment stations in this area. Some of the best of these which have been named and distributed are as follows: Miami in Ohio; College Success, College Wonder, Wolverine, and Worthy in Michigan; Forward and Wisconsin Wonder in Wisconsin; Iogren in Iowa; and Minota in Minnesota.

Forward.—The Forward (Reg. No. 56) is a plant selection from Silvermine developed at the Ashland Branch Experiment Station, University of Wisconsin. It is a white oat, similar to Silvermine, but has a slightly longer kernel. It has outyielded Swedish Select, the standard variety, on the average, by about 6 bushels to the acre. Forward is especially recommended for the red-clay belt along Lake Superior in Wisconsin and for similar soil types in that general region.

Wisconsin Wonder.—The Wisconsin Wonder variety (Reg. No. 62) was originated at Madison, Wis., in 1903, as a plant selection from a local variety known

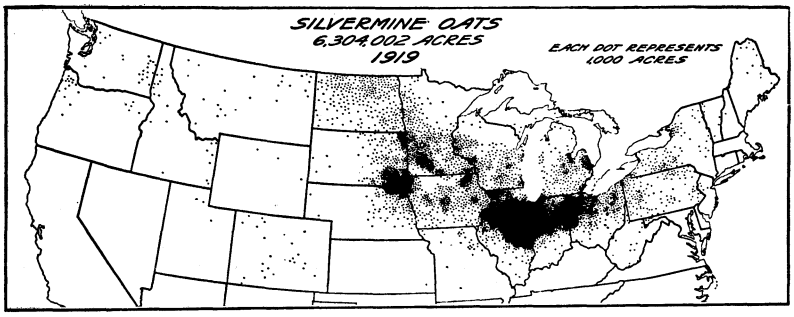

FIGURE 7.—Outline map showing the distribution of the Silvermine oat in 1919

as White Bonanza. It is a white oat, similar to Swedish Select, but the kernels are more slender. Its high-yielding ability and stiff straw have made it a favorite in many districts of Wisconsin and in adjoining States.

Minota.—Minota (Reg. No. 59) resulted from a plant selection from an unnamed variety developed at the Minnesota Agricultural Experiment Station. It is similar to Green Russian, but has shorter straw and yellowish white kernels. Its short, stiff straw and its early to midseason maturity make it a very desirable variety for growing on rich soils, where early varieties are less productive and the taller midseason sorts frequently lodge.

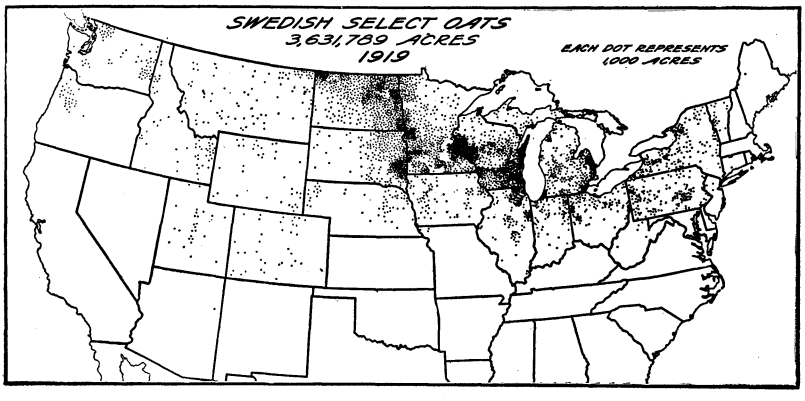

FIGURE 8.—Outline map showing the distribution of the Swedish Select oat in 1919

Iogren.—Iogren (Reg. No. 51) was originated as a plant selection from the Green Russian variety in 1911. It was developed at the Iowa Agricultural Experiment Station in cooperation with the United States Department of Agriculture. It is a yellow oat and is fairly typical of the Green Russian variety. In the experiments at Ames, Iowa, it has exceeded the parent variety in acre yield by about 8 bushels on the average. It is especially recommended for north-central and northwestern Iowa. The distribution of the parent variety, Green Russian, in 1919, is shown in Figure 10.

Miami.—Miami was developed and distributed by the Ohio Agricultural Experiment Station. It was originated as a plant selection (Ohio No. 6203) from Siberian. Miami is a high-yielding white oat similar to Lincoln. It is to-day the leading midseason variety grown in the northern part of Ohio.

Michigan sorts.—The varieties College Success, College Wonder, Wolverine (Reg. No. 70), and Worthy (Reg. No. 71) were developed and distributed by the Michigan Agricultural Experiment Station at East Lansing. These varieties, although especially developed for Michigan, also are well adapted to the

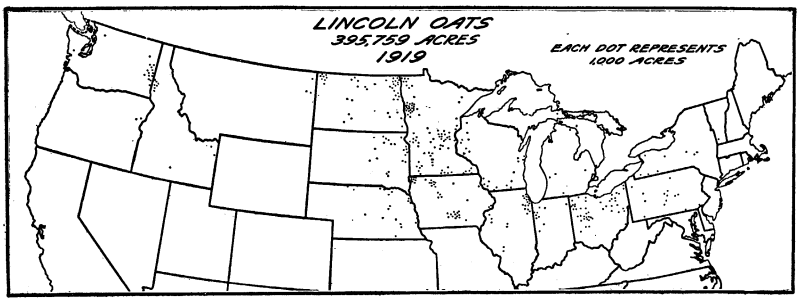

FIGURE 9.—Outline map showing the distribution of the Lincoln oat in 1919

northern parts of Ohio and Indiana and to some districts in Wisconsin. They are similar to Silvermine, and as a group have a stiffer straw than most other midseason varieties. This desirable character has contributed to their popularity in Michigan. Of the four Michigan varieties the Wolverine and Worthy have become the most popular.

In addition to these named varieties, numerous other selections have been developed and distributed by agricultural experiment stations under numbers only. Most of these strains have been

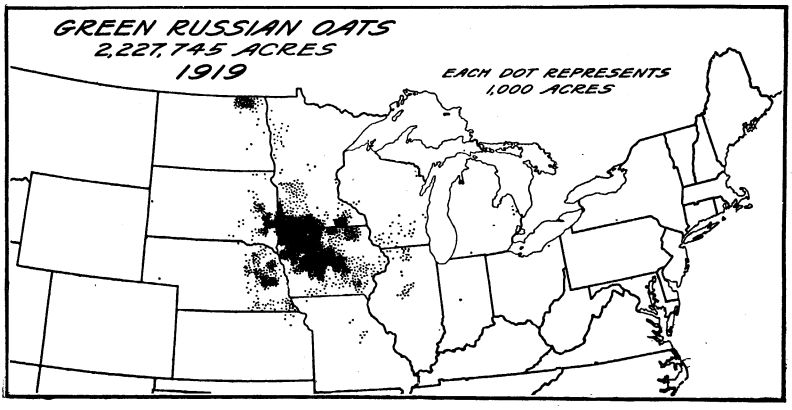

FIGURE 10.—Outline map showing the distribution of the Green Russian oat in 1919

replaced in recent years by the improved named sorts described above.

LATE VARIETIES WITH SIDE PANICLE

The only variety of any importance in this area that has the "side" panicle is White Tartar, also called White Russian and Tartarian. This oat has persisted, especially in the Red River

Valley section of Minnesota and North Dakota, because of its resistance to stem rust. It is inferior in yield to the best midseason varieties with branching panicles. As soon as rust-resistant midseason varieties of the latter type are available, the White Tartar doubtless will be replaced by them. A panicle and spikelets of White Tartar are shown in Figure 12.

FIGURE 11.—Panicles and spikelets of Silvermine (left) and Swedish Select (right) oat varieties

PREPARATION OF THE SEED BED

Ordinarily too little attention is given to the preparation of the seed bed for oats. The idea has persisted that almost any kind of seed bed is satisfactory for this crop. Oats will respond to proper seed-bed preparation as well as any other field crop. In the Corn Belt, where oats usually follow corn, the seed often is sown broadcast without any previous preparation of the land. The seed is covered then by disking and harrowing. Ordinarily, however, it is better practice to disk the land before seeding, regardless of how the seed is to be sown.

The ideal seed bed for oats is one that is rather firm beneath, with 2 to 3 inches of loose, finely pulverized, mellow soil on the surface. Provided the soil is not too wet, usually a fairly good seed bed can be prepared by two single diskings, or one double disking, and by harrowing. Where oats are to be sown on land with standing cornstalks, it is advisable to drag down or break the stalks before disking. This can be done by dragging some kind of a leveling implement such as a planker (sometimes called a drag or float) or a heavy pole or iron rail across the field, preferably on a cold morning when the ground is frozen. The stalks also may be cut down in the field with a stalk cutter, thus hastening their decay. This greatly facilitates the work of the disk harrow and makes it much more efficient. The disks should be set to run 3 or 4

inches deep, and lapping half, or so-called double disking leaves the surface more nearly level than cross or diagonal disking. However, the diagonal method frequently is used with good results. A tandem disk also is often used. Harrowing with a spike-tooth harrow after the disking leaves the seed bed ready for sowing either by drilling or broadcasting. A second disking is necessary to cover the seed when sown broadcast. A spike-tooth harrow is shown in operation in Figure 13.

Pieces of cornstalks and other crop residues should be worked into the soil as much as possible by disking and harrowing to add humus-making material to the soil. A disk harrow is shown in use on cornstalk land in Figure 14.

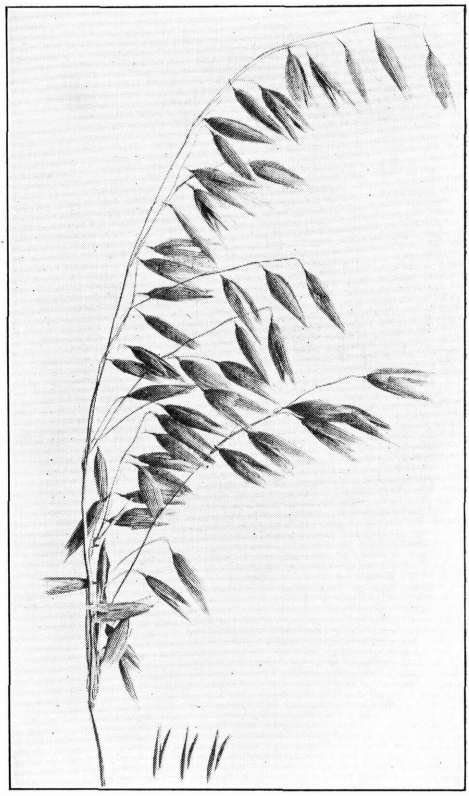

FIGURE 12.—A panicle and spikelets of the White Tartar oat, the only variety with side panicle of economic importance in the United States

Special methods of seed-beed preparation are necessary where oats follow corn in the area infested by the European corn borer. To insure conditions unfavorable to this pest it is essential that all cornstalk residue be completely covered and that no trash of any sort be left on the surface to act as a protection to the insect. As a control measure it is recommended that all corn-stubble land be plowed. A combination coulter and jointer increases efficiency in turning under trash. A heavy chain or wires attached to the plow also may be used to drag under trash and thus insure a better job of plowing. In the cultivation of fields where cornstalks or corn stubble have been plowed under during the fall or spring, only a disk harrow should be used to prepare the seed bed. Otherwise, if a spike-tooth harrow is employed, much of the material plowed under may be dragged to the surface and many of the borers thus escape destruction. A disk drill also should be used in sowing the oats.

Land seldom is plowed where oats follow corn or other row crops, except where necessary because of corn-borer infestation or other special reason. Spring plowing not only adds materially to the cost of seed-bed preparation, and hence cost of production, but usually results in a less satisfactory seed bed. This is owing to the fact that there ordinarily is not sufficient time for the subsurface

soil to become settled and fairly compact before the seed is sown. To speed up farm work in the spring, fall plowing sometimes is advisable, especially where there is little danger of soil puddling or leaching during the winter. Usually a very fine, smooth, mellow seed bed can be obtained by fall plowing.

THE SEED AND ITS PREPARATION

Home-grown seed usually is preferable, provided the seed is pure and represents a high-yielding strain of a variety adapted to the locality. The practice of continually changing from one variety to another is not warranted. The belief that varieties "run out" also is not well founded. Deterioration is due primarily to admixtures of seeds of other varieties and to noxious weeds.

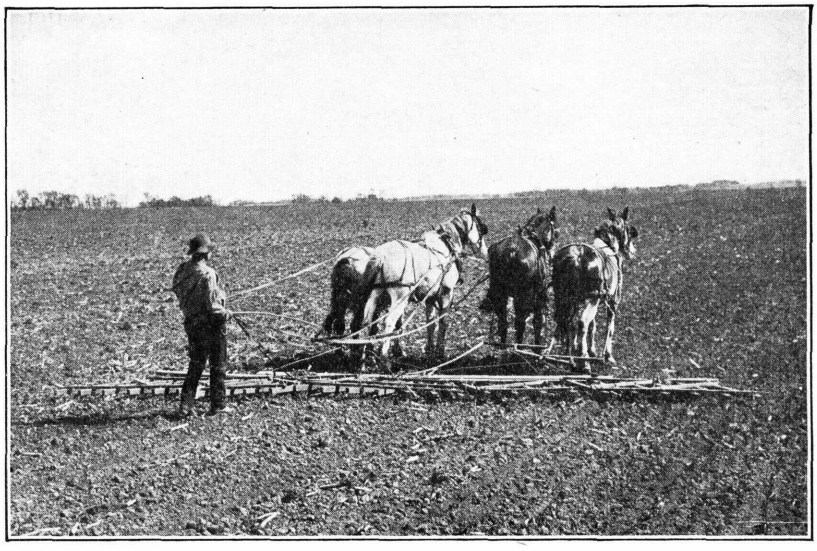

FIGURE 13.—Harrowing corn-stubble land with a spike-tooth harrow after disking in preparing a good seed bed for oats

The germination power of oats usually is good. If the oats have been well cured in the shock or stack and have been stored properly, their viability will remain high for several years.

FANNING AND GRADING

All oats to be used for seed should be fanned and graded to remove weed seeds, chaff, straw, trash, and the small, light, chaffy kernels. It is very essential that these light grains should be screened out, as they often do not contain a kernel and therefore would not germinate even if sown. Fanning and grading oats to the point that only the larger and plumper seeds remain is not necessary.

TREATING THE SEED FOR SMUT[3]

Smut in oats causes a large annual loss that can be almost wholly prevented by treating the seed. The treatments here recommended

[3] Prepared by V. F. Tapke, pathologist, Office of Cereal Crops and Diseases.

are cheap, easy to apply, and very effective. Their use, therefore, is advised whenever it is known or suspected that the seed came from a smutty crop or from a crop that adjoined fields of smutted oats. The formaldehyde treatment which is recommended may be applied as a spray, a sprinkle, or a dip.

THE SPRAYING METHOD

(Also called the "Haskell," "dry," and "mist" method)

(1) Fan and grade the seed oats.

(2) Dump the seed on a clean barn floor or canvas or in a tight wagon box.

FIGURE 14.—Disking corn-stubble ground in preparing a seed bed for oats

(3) Mix 1 pint of formaldehyde (37 per cent by weight) with 1 pint of water and pour into a quart sprayer. This quart of solution will treat 50 bushels. If fewer bushels are to be treated, use a correspondingly smaller quantity of the solution.

(4) Shovel the oats from one pile to another, spraying each shovelful.

(5) After the oats are sprayed, pile them in a heap and cover with blankets, canvas, or sacks which have been thoroughly sprayed with the solution.

(6) Keep the pile covered five hours. After this, the oats may be bagged and drilled.

(7) Precautions: Formaldehyde vapor irritates the eyes, nose, and throat. These effects may be reduced by holding the sprayer down

close to the oats, by shoveling seed on to the vapor, by working from the windward side of the pile, and by treating the seed in a well-ventilated place.

(8) Advantages: The dry treatment does not wet the seed and may be made several weeks before planting if desired. A modification of this method is used with good results in some States. This consists in mixing 1 pint of formaldehyde with 10 pints of water (instead of 1 pint of water as above). This quantity of solution is sufficient for 50 bushels. The treatment is carried out in the same manner as that described above, except that a heavier mist is applied to the seed; that is, about 1 pint of solution to each 5 bushels of seed.

THE SPRINKLING METHOD

(1) Fan and grade the seed oats.

(2) Dump the seed on a clean barn floor or canvas or in a tight wagon box.

(3) Add 1 pint of formaldehyde (37 per cent by weight) to 40 gallons of water. (One pint to only 15 gallons of water is used in some States.) This quantity of solution is sufficient for 50 bushels. Apply the solution with a sprinkling can while the oats are being shoveled from one pile to another, or spread the oats in a thin layer, sprinkle, and shovel over until each seed is thoroughly wet.

(4) Shovel the oats into a pile and cover with canvas, blankets, or sacks that have been thoroughly wet with the solution to kill the smut spores. The pile should be covered at least two hours and may be left covered over night.

(5) On removing the cover, spread out the seed in order to dry it sufficiently to permit sowing. Make allowance for the swollen condition of the seed by setting the drill to sow heavier.

(6) If possible, treatment should be made just before sowing. If sowing is delayed the treated seed should be spread out and thoroughly dried.

THE DIPPING METHOD

(1) Fan and grade the oats.

(2) Put the seed in burlap or gunny sacks (seamless, heavy cotton cloth sacks are not satisfactory). These should be half filled only and tied at the top.

(3) Mix 1 pint of formaldehyde with 40 gallons of water in a large barrel or tank.

(4) Dip the sacks of grain in the solution. Repeat the dipping until each seed is thoroughly wet.

(5) Remove the sacks and let them drain and dry at least two hours or over night. If not used soon after treatment the seed should be spread out to dry and aerate, to stop the action of the formaldehyde.

This method is essentially the same as the sprinkling method described above, except that the seed is dipped in the solution instead of being sprinkled with it. The use of one or the other is a matter of personal preference.

In using the sprinkling and dipping methods, care should be taken to avoid either the freezing or the heating of wet seed. In all methods care should be taken to avoid contaminating the treated seed. Bags

and sacks if used previously for oats should be soaked in the formaldehyde solution or sprayed before treated seed is placed in them. Surplus seed treated with formaldehyde may be fed to livestock without injury, provided it has been first spread out and thoroughly aerated for several days.

Formaldehyde is now readily obtainable at almost any drug store in pint cans. As a consequence, no other measurement of the formaldehyde is necessary.

In the last few years some organic-mercury compounds and chemical dusts have given promising results in controlling oat smut, but these new treatments are still in the experimental stage.

Oat smut produces smut only in oats. Smut in corn, wheat, barley, and other crops will not produce smut in oats.

Healthy and smutted panicles of oats are shown in Figure 15.

SOWING THE SEED

TIME OF SEEDING

One of the most important essentials for success in growing oats is to sow the seed early. The crop is primarily suited to a cool climate and as a result grows best in the cool weather of spring. It often is injured severely by a few hot days during the last stage of the ripening period. Late spring frosts seldom injure oats materially, either before or after emergence. It usually is a safe practice to sow just as early as the land is in condition to work in the spring.

In the southern portion of the North-Central States the best date for seeding ordinarily is the earliest that the land can be worked, as permitted by soil moisture and weather conditions. This usually occurs some time during the last two weeks in March or early in April. In the more northern sections of this area these dates are somewhat later. Usually, if seeding is delayed by weather and other natural causes until May good results can hardly be expected from oats. Immediately north of the Corn Belt, in the central and northern parts of Michigan, Wisconsin, and Minnesota, the optimum date of seeding becomes later with the advance northward. In much of this latter area the best date is from April 15 to April 30. Owing to the cooler climate, later seeding may be followed with a greater degree of safety than in the Corn Belt.

RATE OF SEEDING

The rate of seeding depends to some extent on the condition and fertility of the soil, the method of seeding, and the size of the seed. The condition of the soil as to weeds also is a consideration in seeding rate. More seed is needed on weedy, poorly prepared land than on a well-prepared seed bed. About a fourth more seed is needed when it is sown broadcast instead of by drilling. Usually in broadcasting, some of the seed is not covered or is covered only very lightly, while in other cases the seed is buried too deep, and the plants never reach the surface. More seed also is required for large-seeded than for small-seeded varieties. The usual rate of seeding is from 8 to 12 pecks per acre. Lighter rates than 8 pecks or heavier rates than 16 pecks seldom are used. In Iowa, for ex-

ample, over most of the State the common rate for broadcast seeding is 16 pecks. When drilled, 12 pecks per acre is about the average rate.

FIGURE 15.—Healthy and smutted panicles of oats. Loose smut at left, covered smut at right

METHOD OF SEEDING

Data from experiments conducted by agricultural experiment stations in this area in which drilling and broadcasting oats have been compared indicate that slightly higher average yields have been obtained from drilling. A more economical and uniform distribution of the seed, a more even germination, a more uniform stand, and

possibly better protection against early spring frosts are among the chief advantages of drilling. While the use of the drill is rather general throughout this region, a considerable acreage of oats is still sown broadcast in the Corn Belt, especially with an end-gate seeder on disked corn-stubble land. The advantages of this method are early and rapid seeding and the elimination of the cost of drilling. A disk or spike-tooth harrow is used to cover the seed when sown. Where the land has been double disked and harrowed with a spike-tooth harrow and is in fair to good condition before seeding, shallow disking once or harrowing twice will cover the seed sufficiently. Drilling is preferable where oats are used as a nurse crop, as more space is left for clover and grass to grow and make a stand. A grain drill in operation is shown in Figure 16.

In the Corn Belt the single-disk type of drill is most often used, because it is superior for disked cornstalk land.

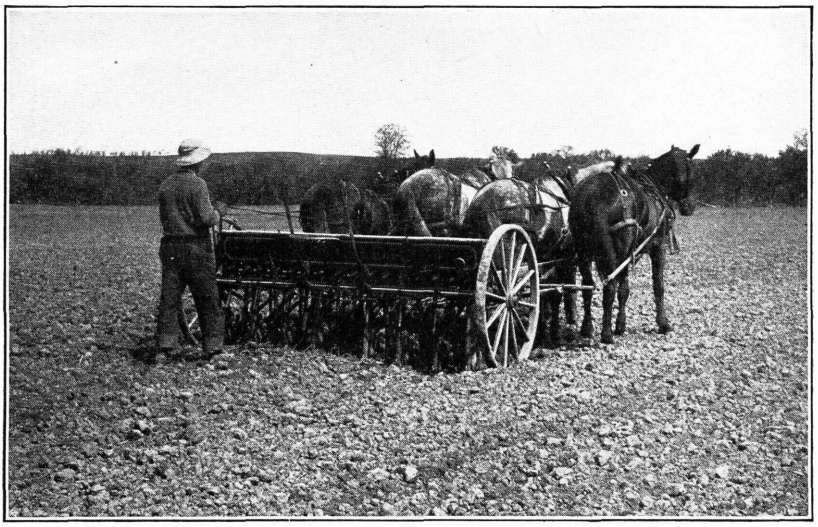

FIGURE 16.—Sowing oats with a grain drill on a well-prepared seed bed in the North-Central States

On a well-prepared, moist seed bed from 1 to 1½ inches is a sufficient depth for sowing oats. In seasons when the rainfall is low and the soil is drier than usual, slightly deeper seeding is advisable.

TREATMENT AFTER SEEDING

In the North-Central States usually no treatment is given oats after the crop is sown. On the more sandy soils, or on spring-plowed land that is cloddy and dry, germination and early growth may be hastened by rolling after seeding. Rolling is seldom advisable, however, after seeding in a well-prepared seed bed. If shortly after seeding heavy rains occur which crust the surface, harrowing with a spike-tooth harrow with the teeth set slanting is advisable. If the teeth are in this position usually the maximum benefit with minimum damage to the grain will result. The harrow teeth will stir the soil sufficiently to kill most of the small weed seedlings in

the surface crust without digging out the young oat plants which are rooted in the lower soil.

Large weeds, such as dock, milkweed, and wild sunflower, which develop with the crop, may be removed by cutting, pulling, or digging without material injury to the oats. The gain from preventing the spread of the weeds more than offsets the loss from trampling incident to their removal. In drilled grain, however, this loss should be very small.

HARVESTING THE CROP

CUTTING

Oats usually are cut with a grain binder. The header and the combined harvester-thresher are as yet little used in this area for harvesting oats. In the last few years the combine has been used on a few farms, with satisfactory results. Such data as are available from definite studies to determine the value of the combine for oats in the Corn Belt indicate that they may be efficiently and economically harvested and threshed by this method. It is doubtful for various reasons whether this method of harvesting ever will completely replace binding.

Where oats are exceedingly short or badly lodged, cutting with a mower sometimes is necessary. This method of harvesting should be used only when it is absolutely impossible to use the grain binder, as much of the grain is lost by shattering when oats are mowed and raked like hay. Where oats are lodged it sometimes is practicable to cut them in one direction with the binder. Although this is a slow, expensive process, it is preferable to cutting them with the mower.

Oats are ready for harvesting with the binder when the kernels are in the hard-dough stage. Oats should be cut at about the time the panicles turn yellow. Under normal weather conditions the panicles usually show a greenish white color for several days before turning yellow. This is a good time at which to harvest the oats, as there will be less loss by shattering and the grain will be of a good color. If oats are cut too early the kernels shrivel in curing and the quality of the grain is lowered. In districts where rains and wind storms frequently occur at the time oats are harvested it usually is a safe practice to start harvesting a little early. Where a large acreage is grown it is necessary to harvest some of the crop a little green in order that a portion of it may not become too ripe before it can be harvested. Oats should not be harvested when damp with rain or dew, as they may discolor and mold in the shock. Harvesting oats with binder and tractor in the Corn Belt is shown in Figure 17.

SHOCKING

The main objects in shocking oats are to permit proper curing and at the same time to protect the grain as much as possible from weathering. If the oats are a little green or weedy and weather conditions are favorable, the bundles may be allowed to cure for a few hours or even a day in the carrier row before shocking. Two kinds of shocks are built, round shocks and long shocks. If the grain is fully ripe and free from weeds the round shock usually is the more satisfactory. It stands up better in windy weather and protects the

oats from weathering better than the long shock. If, however, the oats are green, or the bundles contain many weeds, and especially if the weather is rainy and unfavorable for harvesting, the long shock is preferable. It permits air to pass through the shock more freely and can be capped almost as satisfactorily as the round shock. In many districts in recent years the long shock is left uncapped. This method is not to be recommended except where the grain is dead ripe and is to be threshed from the shock in a few days. Oats should never be shocked when damp with dew or rain, as the grain may mold.

A round shock is built by first setting up two bundles, flat sides together, with the heads placed tightly together and the butts a few

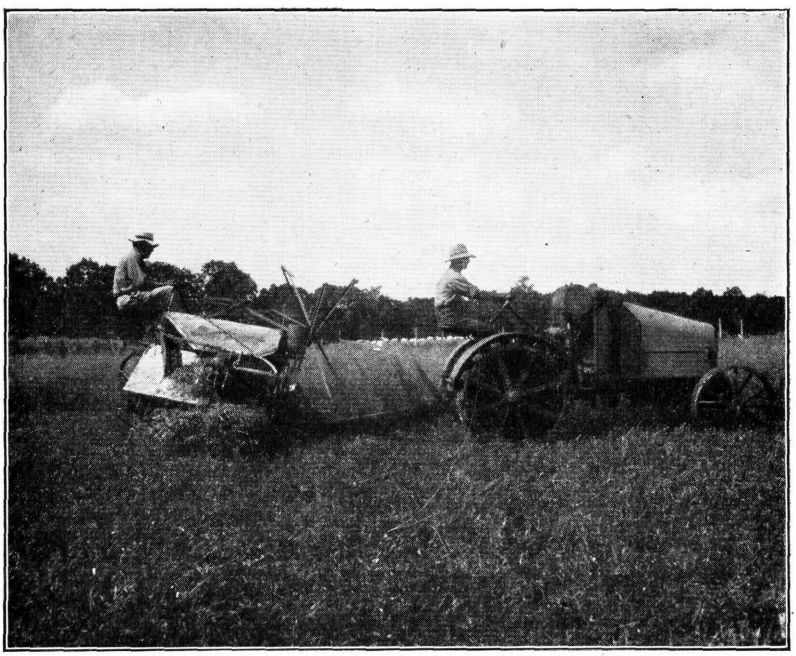

FIGURE 17.—Harvesting oats with binder and tractor in the Corn Belt

inches apart. Most binders make bundles that are somewhat flat, so that when they are set down firmly in the manner described they will stand alone except under windy conditions. Next, set a bundle at each end of this pair so that there will be four in a row. Then set one in the middle of each side, placing the bundles somewhat in a bracelike position. This will leave a space at each corner in which a bundle should be set. Ordinarily the bundles will fit closely into these spaces and thus make a snug round shock of 10 bundles, which is about the required number for a shock that is to stand well. In case the grain is very ripe and dry, slightly larger shocks may be built by adding a few more bundles. In making a round shock in very windy weather it sometimes is advisable to set the third and fourth bundles at the sides instead of at the ends as just described.

The end bundles may then be added and the shock completed as before.

After the required number of bundles have been set up the shock is ready for capping. There is some difference of opinion regarding whether one or two bundles should be used for capping. One cap permits freer circulation of air through the shock, so that the oats will dry out more quickly after rains. Less labor also is necessary, as only one bundle has to be broken. Better protection, however, is afforded by using two caps, as the oats do not get wet so quickly. Carefulness and expert attention to capping always insure better protection of the oats and a better quality of grain.

The cap bundle is broken by supporting it with the butt on the knees and with one forearm and hand under it at the band; then the straw is broken just above the band with the other hand. If one cap is used the head end should be placed always in the direction of the prevailing winds. In case two caps are used the second one

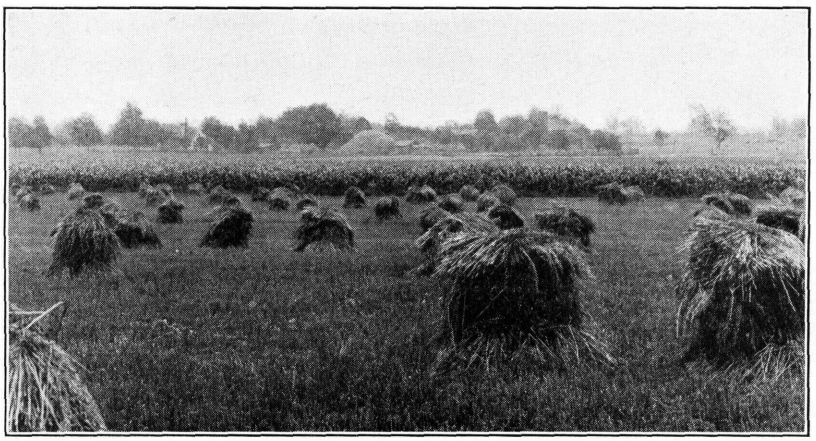

FIGURE 18.—Properly built round shocks of oats with caps to protect the grain from weathering

should be placed similarly, and at right angles to the first. By devoting some attention to this detail very few caps will be blown off under ordinary weather conditions. Round-capped shocks are shown in Figure 18.

In building the long shock the first pair of bundles is set the same as for the round shock, except that the butts ordinarily should be set a little farther apart so as to permit free circulation of air lengthwise through the shock after it is built. The second pair of bundles is then placed alongside the first pair in a similar manner with the bundles leaning slightly toward the first pair. Pairs of bundles then are set at each end alternately in a similar manner until five pairs are in place. Where larger shocks are desired more than five pairs may be set up. However, if this type of shock is made too long it may not stand well under windy conditions. Usually long shocks of this kind are not capped. Where desired, however, the caps should be broken as for a round shock and placed with the butt to the end of the shock, and then the second cap is placed on the other

end in similar fashion with the heads overlapping those of the first cap. Long, uncapped shocks are shown in Figure 19.

STACKING

The common practice in much of the area under consideration is to thresh from the shock. Shock threshing probably is much more general in the Corn Belt proper than in the territory immediately to the north, where stacking is a very frequent practice. Stacking has a number of advantages which offset the saving in costs of threshing from the shock. Stacking insures cleaner threshing and drier and better quality grain. The oats go through a sweat in the stack and are completely cured at time of threshing. Oats threshed directly from the shock too often are damp and not fully cured. When oats are in such poor condition for threshing, considerable grain may go into the straw. Whether oats are stacked or are threshed directly from the shock depends very largely on local conditions.

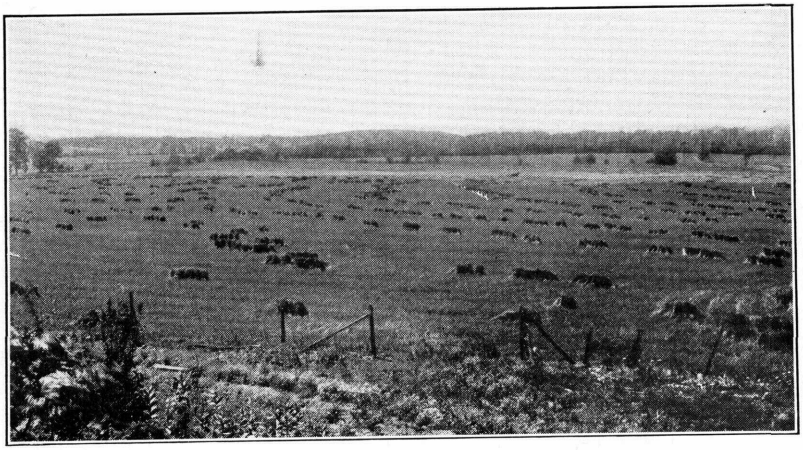

FIGURE 19.—Long, uncapped shocks of oats in the Corn Belt. When this method of shocking is used practically all the grain is exposed to the weather

Stacking is advisable where threshing from the shock is not possible because of the rush of other farm work or the nonavailability of a threshing outfit.

The building of stacks that will shed water and protect the oats is essential. In stacking unless an unusually dry location is available it usually is best to make an improvised foundation by laying down fence posts or rails or other light timbers to keep the oats from absorbing water from the ground and thus damaging the lower portion of the stack. The size of the temporary foundation varies with the size of the stack which is to be built.

To build a round stack, begin at the center with two bundles, precisely as in building a shock; then add bundles to the sides of the shock, placing each one a little flatter until a basal diameter of 10 to 12 feet has been reached. Lay all bundles with the butts outward. The stack progresses to the left, or counterclockwise, and the pitcher places the bundles at the stacker's left, butts to the front.

Start the second layer by placing a row of bundles at the outer edge. The second row should be laid between the bundles of the outer row with the butts extending just past the bands of the outer bundles, and so on to the center, overlapping the rows a little more as the center of the stack is approached, when the builder will start again at the outside and proceed with the third layer.

Shocked bundles have a slanting butt, and beginning with the fourth layer the successive layers should be laid with the long side of the bundle up and extending slightly beyond the layer beneath. In this way the diameter is gradually increased, which should continue until a height of 7 or 8 feet is reached. This forms the bulge of the stack. To reduce danger of slipping while building the bulge, so-called double-row or triple-row courses of bundles may be laid. Instead of laying a single row at a time a course containing two or three rows is laid at each successive round.

The center of the stack always should be kept high, well tramped, and free from holes. The outer row, however, should not be tramped, so that when the stack settles the straws in the exposed butts will slope distinctly downward and shed water perfectly.

From the bulge the stack should taper gradually to a point. The bundles are laid with the short side of the sloping butts up, which decreases the diameter with each successive layer and gives about the desired slope and smoothness to the stack. One row of bundles is usually laid at a time in building the top of the stack, as the drawing-in process greatly lessens the danger of slipping. It is very important in topping the stack that the center be kept well filled and solid, keeping it distinctly higher than the outside and thus forming a good slope downward to the rim of the stack. This is best done by overlapping the rows a little more as the center is reached. The middle also may be kept full by laying some of the inside bundles with the heads out.

The top bundles of the stack should be put on like those of a cap for a shock. These may be held in place by driving a sharpened stake 6 to 8 feet long down into the center. Weights made of two light timbers tied together with rope or wire also may be hung across the top of the stack to keep the top bundles in place. Well-built round stacks are shown in Figure 20.

Long stacks or ricks may be built similarly. However, more skill is required to build this type of stack, and for this reason the smaller round stack usually is preferable.

THRESHING

Threshing from the shock should never be attempted when the oats are damp from rain or from going through the sweat. Oats may be threshed either before or after sweating in the shock. When threshing is done before sweating the grain will go through the sweat in the bin. If the oats are dry when threshed from the shock, even before going through the sweat, there is little danger that they will spoil in the bin. Usually, however, it is better practice to allow the oats to become well cured in the shock before threshing. Where stacking is practiced, sufficient time, as a rule, elapses between stacking and threshing to allow the oats to cure thoroughly in the stack.

The essentials of good threshing require that all grain shall be removed from the straw, that the grain shall not be cut unduly by the cylinder teeth, and that the separators shall clean reasonably well. Where registered or pedigreed varieties are being grown, it is advisable to see that the separator is thoroughly cleaned at the beginning of the run. By strict attention to this detail, it is possible for individual farmers to keep their varieties in a pure condition for a number of years and also to prevent the spread of noxious weed seeds from one farm to another.

OAT STRAW

Oat straw should be saved and protected from the elements. If barn or mow space is available, it should be blown directly into the

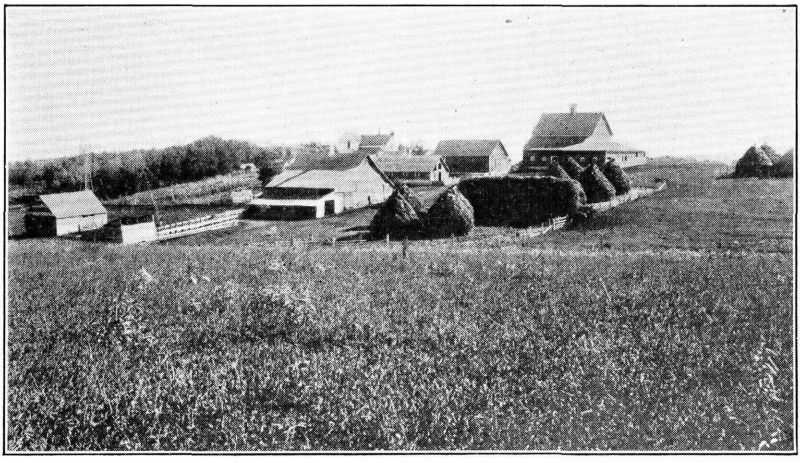

FIGURE 20.—A well-drained stack yard and properly built round stacks of oats on a Corn-Belt farm

mow. If it is necessary to stack it in the open, the stack should be built carefully so that it will shed water. Oat straw is a valuable roughage for livestock, being superior for this purpose to wheat or barley straw, owing to its softer texture and greater palatability. Where oat straw is especially desired for roughage it is sometimes advisable to cut oats just a little green. When cured such straw is brighter and has a higher feeding value than when allowed to become too ripe. Oat straw not needed for feeding purposes is of value for bedding farm animals and the making of manure. When used in this manner it absorbs the liquid manure and prevents loss of valuable fertilizing constituents. Each 1,000 pounds of oat straw contains on an average about 5 or 6 pounds of nitrogen, about 2 pounds of phosphoric acid, and 10 to 15 pounds of potassium (potash).